Mosyakin, S.L., L.M. Shultz & G.V. Boiko. 2017. Types of sagebrush updated (*Artemisia* subg. *Tridentatae,* Asteraceae): miscellaneous comments and additional specimens from the Besser and Turczaninov memorial herbaria (KW). Phytoneuron 2017-25: 1–20. Published 6 April 2017. ISSN 2153 733X

TYPES OF SAGEBRUSH UPDATED (*ARTEMISIA* SUBG. *TRIDENTATAE*, ASTERACEAE): MISCELLANEOUS COMMENTS AND ADDITIONAL SPECIMENS FROM THE BESSER AND TURCZANINOV MEMORIAL HERBARIA (KW)

SERGEI L. MOSYAKIN
M.G. Kholodny Institute of Botany
National Academy of Sciences of Ukraine
2 Tereshchenkivska Street
Kiev (Kyiv), 01004 Ukraine
inst@botany.kiev.ua

LEILA M. SHULTZ
Department of Wildland Resources, NR 329
Utah State University
Logan, Utah 84322-5230, USA
l.shultz@usu.edu

GANNA V. BOIKO
M.G. Kholodny Institute of Botany
National Academy of Sciences of Ukraine
2 Tereshchenkivska Street
Kiev (Kyiv), 01004 Ukraine
bav22@ukr.net

ABSTRACT

Corrections and additions are provided for the existing typifications of plant names in *Artemisia* subg. *Tridentatae*. In particular, second-step lectotypifications are proposed for the names *Artemisia trifida* Nutt., nom. illeg. (*A. tripartita* Rydb., the currently accepted replacement name), *A. fischeriana* Besser (= *A. californica* Lessing, the currently accepted name), and *A. pedatifida* Nutt. For several nomenclatural types of names listed in earlier publications as "holotypes," the type designations are corrected to lectotypes (Art. 9.9. of *ICN*). Newly discovered authentic specimens (mostly isolectotypes) of several names in the group are listed and discussed, mainly based on specimens deposited in the Besser and Turczaninov memorial herbaria at the National Herbarium of Ukraine (KW). The Turczaninov herbarium is particularly rich in Nuttall's specimens, which are often better represented and better preserved than corresponding specimens available from BM, GH, K, PH, and some other major herbaria.

Artemisia L. subg. *Tridentatae* (Rydb.) McArthur (Asteraceae), containing sagebrush species, is a morphologically, geographically and phylogenetically well outlined group restricted exclusively (or mainly?) to North America, which was recently treated taxonomically by Shultz (2006b, 2009). Recent molecular phylogenetic studies confirmed a rather isolated position of the group within the genus (Kornkven et al. 1998, 1999; Torrell et al. 1999; Watson et al. 2002; Vallès et al. 2003; Sanz et al. 2008; Garcia et al. 2011a) but also demonstrated that it is phylogenetically rooted in *Artemisia* subg. *Artemisia* in its current rather wide circumscription. It was also confirmed (Vallès et al. 2003; Sanz et al. 2008; Garcia et al. 2011a) that the previously recognized genera *Picrothamnus* Nutt. and *Sphaeromeria* Nutt. (see Nuttall 1841; Holmgren et al. 1976; Cronquist 1994; Shultz 2006a, 2006b; Lowrey & Shultz 2006 etc.) should be included in it. New nomenclatural combinations in *Artemisia* have been already proposed for the majority of taxa earlier included in *Sphaeromeria* (Garcia et al. 2011b). Since the "*A. tridentata* clade" is phylogenetically sister to *Artemisia* subg. *Artemisia* sect. *Artemisia* sensu lato, the sectional rank for "sagebrushes" is probably justified, or, alternatively, some other clades should be recognized as subgenera, if the subgeneric rank is retained for the "*A. tridentata* clade." Further changes in infrageneric taxonomy of the genus seem to be inevitable.

However, pending further research, for convenience here we refer to that group as "subg. *Tridentatae,*" in the circumscription accepted by Shultz (2006b, 2009), with addition of some taxa, as suggested by Garcia et al. (2011b).

The data on types of names of most taxa of that subgenus (in its traditional circumscription) were summarized by Shultz (2009), and earlier by Cronquist (1994). However, for some names, corrections and sometimes second-step lectotypifications were needed.

In the course of the preparation of the present note we consulted the available databases of scanned herbarium specimens (mainly JSTOR Global Plants 2017–onward) and, most importantly, the vast collections of historical herbarium specimens of *Artemisia* deposited in the memorial herbaria of Besser and Turczaninov in the National Herbarium of Ukraine (KW, Herbarium of the M.G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine; here and below the herbarium acronyms are given following Thiers 2017–onward).

Willibald [in some sources Wilibald] Swibert Joseph Gottlieb von Besser (1784–1842; in Russian sometimes mentioned as Виллибальд Готтлибович Бессер), an Austrian-born botanist who worked mainly in Kremenets and Kiev (formerly the Russian Empire, now Ukraine), was one of early monographers of *Artemisia* who published several important contributions on taxonomy of the genus (Besser 1829, 1832, 1834a, 1834b, 1835) and also contributed to the treatment of *Artemisia* in de Candolle's *Prodromus…* (Candolle "1837," published 1838). Many of his taxa are still widely recognized in standard floras and manuals (Poljakov 1961; Korobkov 1992; Krasnoborov 1997; Ling et al. 2011; Shultz 2006b etc.; see also IPNI 2017–onward). Nikolai (Nicolai or Nicholas) Stepanovich Turczaninov (1796–1863; Николай Степанович Турчанинов in Russian; also sometimes transliterated as Turczaninow, Turchaninov, Turtschaninow, or Turtschaninoff) was a devoted plant collector and taxonomist who exchanged plant specimens with many contemporary botanists and accumulated a large herbarium of more than 150 000 specimens (probably much more than 170 000 specimens, if we consider specimens placed on the same sheet or in the same folder/envelope). Main collections of these two botanists are deposited in KW as two memorial herbaria kept separately from other KW collections, while their duplicate specimens are also available from many other herbaria (Jain 1970; Stafleu & Cowan 1976, 1986; Myakushko 1976; Marchant 1990; Krytzka & Mosyakin 2002; Shiyan 2011 etc.).

Both these historical collections are amazingly rich in types from all parts of the world; many types (especially those of taxa described by Turczaninov himself) have been already identified, scanned and databased (see JSTOR Global Plants 2017–onward), but many other type specimens still remain in these general collections, awaiting proper identification and further research. In particular, the Turczaninov herbarium contains numerous North American specimens collected by Thomas Nuttall (1786–1859), but complete inventory of these specimens has not been done yet. Nuttall's original collections are mainly deposited in BM and PH, with additional specimens or duplicates in GH, K, MO, NY, OXF, and some other herbaria (see Stafleu & Cowan 1981).

Type specimens of *Artemisia* subg. *Tridentatae*: corrections and second-step lectotypifications

The taxa are listed below following the treatment by Shultz (2009). If necessary, notes on their corrected typification are provided.

ARTEMISIA CANA Pursh, Fl. Amer. Sept. 2: 521. 1814. *Seriphidium canum* (Pursh) W.A. Weber, Phytologia 55: 7. 1984. **TYPE**: According to the protologue: "On the Missouri. *M. Lewis.* Aug.–Oct. *v. s. in herb. Lewis.*" As cited by Shultz (2009: 37): "U.S.A.: "on the bluffs of the Missouri River," *M. Lewis 60* (lectotype, here designated: PH-LC 19)." **LECTOTYPE**: PH-LC 19 (PH00043165), designated by Cronquist (1994), corrected and verified by Reveal et al.

(1999), and accepted by Shultz (2009); image available from JSTOR Global Plants (2017–onward).

Artemisia columbiensis Nutt., Gen. N. Amer. Pl. 2: 142. 1818. **TYPE**: According to the protologue (Nuttall 1818: 142): "On the arid and saline hills which border the Missouri and the lesser streams, commencing about 30 miles below White River; and continuing to the Mountains (or Northern Andes), it occurs still more abundantly on the barren plains of the Columbia river <…>. It is the plant which was known to the party of Lewis and Clarke by the name of "Wild Sage," and appears to be *A. cana* of Pursh. Fl. Am. 2. p. 521." As cited by Shultz (2009: 38): "U.S.A.: "on arid & saline hills that border the Missouri & lesser streams, commencing ca. 30 miles below the White River (plant called 'wild sage' by Lewis & Clark)," [1811], *T. Nuttall s.n.* (holotype: PH!)." **LECTOTYPE**: *Nuttall, s.n.* PH00008343, designated by Shultz (2009, as "holotype"); image available from JSTOR Global Plants (2017–onward).

In her treatment Shultz (2009: 37) cited as the type of *Artemisia cana* the specimen "*Lewis 60* (lectotype, here designated: PH-LC 19!)". In fact, the lectotype was designated by Cronquist (1994: 162) who, however, cited it as the "holotype" (an error correctable under Art. 9.9 of *ICN*: McNeill et al. 2012), and with a wrong collection number (6 instead of 60, evidently a technical error). These errors were corrected by Reveal et al. (1999: 10), who properly termed this specimen as the lectotype and commented that it was collected "near the mouth of the Cheyenne River in Stanley Co., South Dakota". Several historical collections of *A. cana* in the memorial herbaria of Besser and Turczaninov (KW) do not represent original material used by Pursh (1814).

In his protologue of *A. columbiensis*, Nuttall (1818) cited numerous localities in the western part of the USA (see above). Any specimens (known or still unidentified) collected and identified by Nuttall and matching these localities are technically syntypes. Since Nuttall did not indicate (directly or indirectly) any specimen as the type and we cannot exclude the existence of additional specimens (syntypes), the specimen PH00008343 should be treated as the lectotype designated by Shultz (2009). No authentic specimens identified as *A. columbiensis* were found at KW.

ARTEMISIA TRIPARTITA Rydb., Mem. New York Bot. Gard. 1: 432. 1900. *Seriphidium tripartitum* (Rydb.) W.A. Weber, Phytologia 55: 8. 1984. *Artemisia trifida* Nutt., Trans. Amer. Philos. Soc., n. s., 7: 398. 1841, *nom illeg.*, *non* Turcz. 1832. *Artemisia tridentata* Nutt. subsp. *trifida* H.M. Hall & Clements, Publ. Carnegie Inst. Wash. 326: 137. 1923. *Artemisia tridentata* Nutt. var. *trifida* (H.M. Hall & Clements) McMinn, Man. Calif. Shrubs: 608. 1939. **TYPE**: According to the protologue (Nuttall 1841: 398): "Plains of the Rocky Mountains and Oregon." As cited by Shultz (2009: 46): "Plains of the Rocky Mts.," [probably Idaho, 1834], *T. Nuttall s.n* (holotype: BM!; isotypes: PH!, GH!)." **LECTOTYPE** (here designated, second-step lectotypification): Plains of the Columbia & R. Mts., *Nuttall s.n.* BM000810854, image available from JSTOR Global Plants (2017–onward); isolectotypes: GH00002743, KW001002845 and KW001002846 (Figure 1), PH00025116.

Artemisia tripartita is the replacement name proposed by Rydberg (1900) instead of the illegitimate name *A. trifida* Nutt. (Nuttall 1841). Consequently (Art. 7.4 of *ICN*: McNeill et al. 2012), it has the same type as the replaced name. Both Cronquist (1994) and Shultz (2009) cited Nuttall's specimen from BM as the "holotype". However, in the protologue there is no indication of any particular specimen as the type. Thus, all specimens of the same origin deposited in various herbaria are technically syntypes, and the selection of a lectotype was necessary. The designation of the specimen from BM as the "holotype" should be thus corrected to the lectotype (Art. 9.9 of *ICN*: McNeill et al. 2012). However, there are three specimens (BM000810853, BM000810854, BM000810855) mounted on the same sheet in BM, and two of them (BM000810854 and BM000810855) were collected by Nuttall and belong to original material of *A. trifida* (and

BM000810855 belongs to Nuttal's variety "β *rigida", see below). Consequently, Cronquist (1994) and Shultz (2009) did the first-step lectotypification. Here we propose the second-step lectotypification and designate the specimen BM000810854 ("Plains of the Columbia & R. Mts." collected by Nuttall) as the lectotype.

The specimens from PH, GH, and the newly discovered duplicates from KW (see below) can be thus treated as isolectotypes. There are two Nuttall's specimen in the Turczaninov herbarium at KW: "*Art. trifida* Nutt. Nuttall. R. Mts." (KW001002846) and "*Artemisia trifida*. Oregon. R. Mts." (KW001002845; handwriting by Nuttall), both on the same sheet with KW001002847 ("*Artemisia trifida* β. *rigida", see below) (Figure 1). These specimens are represented by plant fragments (probably parts of more complete specimens?), provided to Turczaninov either directly by Nuttall or by some other person.

The name *Artemisia tridentata* subsp. *trifida* H.M. Hall & Clements (1923) is sometimes cited with the authorship "(Nutt.) H.M. Hall & Clements" (see, for example, Shultz 2009: 46). However, since the name *A. trifida* Nutt. is illegitimate, the subspecies name should be treated as a new replacement name authored by Hall & Clements, with the same type as the illegitimate species name (Art. 58.1 of *ICN*: McNeill et al. 2012). The authorship of the variety, *A. tridentata* var. *trifida*, should be thus cited as "(H.M. Hall & Clements) McMinn".

ARTEMISIA RIGIDA (Nutt.) A. Gray, Proc. Amer. Acad. Arts 19: 49. 1883. *Artemisia trifida* Nutt. var. *rigida* Nutt., Trans. Amer. Philos. Soc., n. s., 7: 398. 1841. *Seriphidium rigidum* (Nutt.) W.A. Weber, Phytologia 55: 8. 1984. **TYPE**: According to the protologue (Nuttall 1841: 398): "From the plains of Lewis' River, in the Rocky Mountains, I have a variety, β. *rigida, in which the leaves are shining and silky, rigidly three-forked and acute, but of this I have no flowers. It is, perhaps, a distinct species." As cited by Shultz (2009: 51): "U.S.A. [presumably Washington]: "plains of the Lewis [Snake] River" [presumably 1834], *T. Nuttall s.n.* (holotype: BM!; isotype: PH!)." **LECTOTYPE**: Lewis River, *Nuttall s.n.*, BM000810855, designated by Cronquist (1994, as "holotype") and verified by Shultz (2009, as "holotype"); image available from JSTOR Global Plants (2017–onward); isolectotypes: BM000810855 (?), GH00002743, KW001002847 (?) (Figure 1), PH00025116.

The specimen from BM listed by Cronquist (1994) and Shultz (2009) as the "holotype" is in fact the lectotype (Art. 9.9 of *ICN*: McNeill et al. 2012). Additional specimens are available from PH (PH00025116) and GH (GH00002743), both verified by Shultz as "isotypes" (in fact, isolectotypes) of *A. trifida* var. *rigida* (see JSTOR Global Plants 2017–onward). A specimen "*Artemisia trifida* β *rigida. R. Mts. [Rocky Mountains]. Nuttall" recently found in the Turczaninov herbarium (KW KW001002847; Figure 1) is also most probably an isolectotype.

ARTEMISIA ARBUSCULA Nutt., Trans. Amer. Philos. Soc., n. s., 7: 398. 1841. *Seriphidium arbusculum* (Nutt.) W.A. Weber, Phytologia 55: 7. 1984. **TYPE**: According to the protologue (Nuttall 1841: 398): "On the arid plains of Upper California, on Lewis' River." As cited by Shultz (2009: 54): "U.S.A., [presumably Washington]: "arid plains of the Lewis [Snake] River" [presumably 1834], *T. Nuttall s.n.* (holotype: BM!; isotypes: PH!, GH!, K!)." **LECTOTYPE**: BM001025660, designated by Cronquist (1994, as "holotype") and verified by Shultz (2009, as "holotype"); image available from JSTOR Global Plants (2017–onward); isolectotypes: GH00002691, K000942175, KW001002848 (?) (Figure 2), KW001002849 (Figure 2), PH00025095.

As with some other type designations discussed above, the "holotype" cited by Cronquist (1994: 160) and Shultz (2009: 54) is in fact the lectotype, and the specimens from PH (PH00025095),

GH (GH00002691) and K (K000942175) mentioned by Shultz (2009) are thus isolectotypes (images available from JSTOR Global Plants 2017–onward). Two additional authentic specimens were found in the Turczaninov collection at KW: "*Artemisia arbuscula*. Nuttall. R. Mts." (KW001002848) and "*Artemisia arbuscula* Nutt. Nuttall. Lewis River. U. Cal. [Upper California]" (KW001002849) (Figure 2). At least the second specimen from KW can be reliably considered an isolectotype.

ARTEMISIA TRIDENTATA Nutt., Trans. Amer. Philos. Soc., n. s., 7: 398. 1841. *Seriphidium tridentatum* (Nutt.) W.A. Weber, Phytologia 55: 8. 1984. **TYPE**: According to the protologue (Nuttall 1841: 398): "Plains of the Oregon, and Lewis' River." As cited by Shultz (2009: 75): "U.S.A.: "plains of the Columbia River" [probably in Oregon or Washington, 1834 or 1835], *T. Nuttall s.n.* (lectotype, designated by Cronquist, 1994: PH!)." **LECTOTYPE** (designated by Schultz 2009: 75): PH00004399, see below; image available from JSTOR Global Plants (2017–onward); isolectotypes: BM001025663, GH00002740, KW001002841 (Figure 3).

Shultz (2009: 75) listed the specimen from PH as the lectotype designated by Cronquist (1994: 158). However, when considering the type of *Artemisia tridentata*, Cronquist (1994: 158) mentioned two specimens ("*Nuttall*, plains of the Oregon; represented at BM!, PH!") and commented that "[t]he PH specimen is clearly the variety to which the name has traditionally been applied; the BM specimen is ambiguous and might belong to the phase here called var. *wyomingensis*." Since Cronquist did not **explicitly** indicate a specimen from either PH (PH00004399) or BM (BM001025663) as the type (lectotype), in our opinion, effective lectotypification of the name has been done by Shultz (2009). The image of an additional isolectotype (GH00002740) is available online (JSTOR Global Plants 2017–onward). There is one additional authentic Nuttall's specimen of *A. tridentata* in the Turczaninov collection at KW: "*Artemisia tridentata* Nuttall. Oregon. R. Mts. [Rocky Mountains]. Nuttall" (KW001002841), which can be treated as an isolectotype (Figure 3).

ARTEMISIA CALIFORNICA Lessing, Linnaea 6: 523. 1831. *Crossostephium californicum* (Lessing) Rydb., N. Amer. Fl. 34(3): 243. 1914. **TYPE**: According to the protologue (Lessing 1831: 523): "Ill. de Chamisso in California (v. sp. s. ∞)." As cited by Shultz (2009: 97): "U.S.A. California: San Francisco [1816], *Chamisso s.n.* (holotype: HAL!; isotypes: GH!)." **LECTOTYPE**: HAL0105121, designated by Shultz (2009, as "holotype"; see below); image available from JSTOR Global Plants (2017–onward); isolectotypes: GH00002698, KW001000941 (Figure 4), LE00018144.

Artemisia fischeriana Besser, Tent. Abrotanis: 21. 1832 (preprint from Nouv. Mém. Soc. Imp. Naturalistes Moscou); Besser, Nouv. Mém. Soc. Imp. Naturalistes Moscou 3: 21. 1834. **TYPE**: According to the protologue (Besser 1832: 21): "Ad sinum S. Francisci Californiæ in planitie, unde ab amicissimo Eschscholtzio: prætera in herbarii clarissimi Fischeri Directoris horti botanici Imperatorii Petropolitani etc et D^{ris} Fleischeri (v. sp. s.)." As cited by Shultz (2009: 97): "U.S.A. California: San Francisco Bay, *Eschscholtz s.n.* (holotype: KW!)." **LECTOTYPE** (here designated, second-step lectotypification; see below): KW001000943 (Figure 5); isolectotypes: KW001000942 (Figure 6), KW001000938 (Figure 7).

Artemisia foliosa Nutt., Trans. Amer. Philos. Soc., n. s., 7: 397. 1841. *Crossostephium foliosum* (Nutt.) Rydb., N. Amer. Fl. 34(3): 243. 1914. **TYPE**: According to the protologue (Nuttall 1841: 397): "Common round Monterrey, in Upper California." As cited by Shultz (2009: 97): "U.S.A. California: Monterey [1834], *T. Nuttall s.n.* (holotype: PH!)." **LECTOTYPE**: PH00025097, designated by Shultz (2009, as "holotype"); image available from JSTOR Global Plants (2017–onward); isolectotypes: GH00002701 (?), KW001002842 (Figure 8).

Artemisia abrotanoides Nutt., Trans. Amer. Philos. Soc., n. s., 7: 399. 1841, *nom. illeg., non* Jacq. ex DC. 1838. — **TYPE**: According to the protologue (Nuttall 1841: 399): "Near St. Barbara, Upper California." As cited by Shultz (2009: 97): "U.S.A. California: near Santa Barbara,

[1836], *T. Nuttall s.n.* (holotype: BM!)." Probable **HOLOTYPE**: BM, digital image not traced (assuming there is only one original specimen; Art. 9.1 of *ICN*).

Both Cronquist (1994) and Shultz (2009) listed a specimen from HAL as the "holotype" of *Artemisia californica*. However, since several collections of Ludolf Karl Adelbert von Chamisso (1781–1838) made at San Francisco Bay exist in several herbaria (GH00002698, LE00018144 – listed in the JSTOR Global Plants database as "San Tranurco", which is evidently a misspelling of San Francisco, etc.), the HAL specimen (HAL0105121) should be regarded the lectotype (Art. 9.9 of *ICN*: McNeill et al. 2012). There is one additional specimen in the Besser herbarium at KW, which is also an isolectotype: "*Artemisia californica* Lessing. San Francisco Californiae. A. Chamisso. E Herb. reg. Berol. 40" (KW001000941). The provenance note ("E Herb. reg. Berol. 40") indicates that the specimen was received by Besser in 1840 from the Berlin herbarium (now B); it was Besser's usual practice to indicate the origin of his specimens in that way (see Mosyakin et al. 2017). An additional curatorial label with the typographically printed heading "Herbarium Universitatis S^{ti} Vladimiri" (Herbarium of St. Vladimir University of Kiev) has the handwritten inscription "Herbarium Besseri". The specimen BM001025667 listed in the online database (JSTOR Global Plants 2017–onward) as the "type of *Artemisia californica*" was collected by Nuttall and thus is not part of the original material.

Shultz (2009) listed a specimen from KW as the "holotype" of *Artemisia fischeriana* Besser. However, in the Besser collection at KW there are several original specimens (mounted on three sheets) collected by Johann Friedrich Gustav von Eschscholtz (1793–1831) and his co-collector (see below) in San Francisco Bay and annotated by Besser as *A. fischeriana*. Consequently, the second-step lectotypification was needed. Thus, we designate here the specimen KW001000943 as the lectotype (Figure 5). This specimen consists of two plant fragments (both most probably representing parts of the same plant, or definitely parts of the same collection) and has the small label "Californien" with an additional inscription by Besser "Esch. 31", where "Esch." means Eschscholtz and "31" is the year (1831) of provenance. There are two additional labels, one with a complete handwritten description of the new taxon made by Besser, with the name "*Fischeriana*" and the geographical origin ("Ad Sin. S. Francisci Californ. Esch. Hbr. Fisch.") written on the top. "Hbr. Fisch." indicates that the specimen has been received by Besser from Fischer's herbarium. Since the species epithet commemorates the German-born Russian botanist Friedrich Ernst Ludwig von Fischer (1782–1854; also known in Russian as Фёдор Богданович Фишер), it is an additional argument in favor of selecting this specimen as the lectotype. A small envelope with loose fragments of inflorescences glued in the lower right part of the sheet has the name "*Artemisia. A. californica*" written by some unidentified person.

The second specimen (KW001000942, Figure 6) is represented by a rather large terminal fertile branch, with the original label in German: "Bei Californien, [one word illegible; probably "basin"?] Port St. Francisco. Esch. 1831". The provenance note ("Esch. 1831") added by Besser indicates that the plant was collected or provided by Eschscholtz and received by Besser in 1831.

Another sheet has two specimens (Figure 7). The first one (KW001000939) is represented by a terminal branch and has the label "*Artemisia Fischeriana* mihi. S^{t}. Francisco. Hb. Acad. Imp. Sc. Choris". This specimen was collected by Louis (also Ludovik or Ludwig) Choris (1795–1828), a German-Ukrainian painter and explorer, a co-collector of Eschscholtz and Chamisso, who also participated in the expedition onboard the ship *Rurik* (also *Rurick* or *Ryurik*; *Рюрик* in Russian) during 1815–1818 under the command of Otto von Kotzebue and spent October 1816 in San Francisco Bay (Kotzebue 1821; Choris 1822, 1913). The specimen was received by Besser from the herbarium of the Imperial Academy of Sciences in St. Petersburg (now mainly part of LE). The second specimen (KW001000938, on the same sheet with KW001000939) has two fragments of terminal branches and the label "Remittenda. Ad Sinum S. Francisci Californiae. Eschscholtz". The

two cited specimens (KW001000942 and KW001000938) collected by Eschscholtz in San Francisco can be considered isolectotypes. Some additional isolectotypes can be expected in other German and Russian herbaria.

When preparing his treatment, Besser (1832, 1834) probably was unaware of the new species *Artemisia californica* already described by Lessing (1831) just one year before, and thus he published his description of the new species *A. fischeriana*, which is in fact conspecific with *A. californica*. As discussed earlier (Mosyakin et al. 2017), the preprint (Besser 1832) of Besser's treatment (Besser 1834a) was published already in 1832, only shortly after the publication of the work by Lessing.

The specimen from PH (PH00025097) listed by Shultz (2009) as the "holotype" of *Artemisia foliosa* Nutt. should be considered the lectotype (Art. 9.9 of *ICN*: McNeill et al. 2012) because of the existence of several other original specimens (syntypes). In particular, we found in the Turczaninov collection at KW an additional isolectotype with the following label: "*Artemisia *foliosa*. Monterrey. U. California. Nuttall" (KW001002842, Figure 8). This specimen has an additional label, "Artemisias. R. Mts. Nuttall," which was probably originally supplied by Nuttall with several other specimens or their fragments. A specimen from GH with the label "Monterrey" (GH00002701) is most probably also a fragment of some other original specimen (isolectotype?).

No authentic specimens annotated as *Artemisia abrotanoides* have been found at KW.

Some taxa not treated by Shultz (2009) but now included in *Artemisia* subg. *Tridentatae*

As mentioned above, molecular phylogenetic studies (see Garcia et al. 2011a, 2011b and references therein) demonstrated that several additional species of *Artemisia* and all species earlier placed of *Sphaeromeria* and *Picrothamnus* should be included in *Artemisia* subg. *Tridentatae*. We found in the Turczaninov herbarium at KW several authentic specimens of *A. pedatifida* Nutt., *Sphaeromeria argentea* Nutt., and *S. capitata* Nutt. collected and annotated by Nuttall. These taxa were not included in the taxonomic monograph by Shultz (2009). Nomenclatural notes on *A. pedatifida* are provided below.

ARTEMISIA PEDATIFIDA Nutt., Trans. Amer. Philos. Soc., n. s., 7: 399. 1841. **TYPE**: According to the protologue (Nuttall 1841: 399): "Arid plains of Lewis' River, Rocky Mountains." As cited by Shultz (2009: 110): "U.S.A. Idaho: "arid plains of Lewis [Snake] River," *T. Nuttall s.n.* (holotype: GH!)." **LECTOTYPE** (here designated, second-step lectotypification, see below): Arid plains of Lewis' River, *Nuttall, s.n.* GH00002722,; image available from JSTOR Global Plants (2017–onward); isolectotypes: GH00002723, K000942263, KW001002850 and KW001002851 (Figure 9), PH00004387.

Shultz (2009: 29) preferred to keep this species in *Artemisia* subg. *Dracunculus* Besser but listed it among "Excluded species" and provided the type information (see above). However, there are at least two original specimens in GH and several more in other herbaria, and thus the designation of a "holotype" by Shultz (2009) can be regarded as a first-step lectotypification. The second-step lectotypification is proposed here. Images of additional specimens (isolectotypes) from GH, K, and PH are available from JSTOR Global Plants (2017–onward).

We found in the Turczaninov herbarium at KW two additional specimens (isolectotypes, on the same sheet) collected by Nuttall: "*Artemisia pedatifida*. Nuttall. R. Mts." (KW001002851) and "*Artemisia pedatifida*. Lewis River [handwriting by Nuttall]" (KW001002850) (Figure 9).

Nuttall's species earlier placed in *Sphaeromeria* and now transferred to *Artemisia* will be discussed in detail in a separate article.

Conclusions

Our analysis of the existing type designations of selected names of taxa now placed in *Artemisia* subg. *Tridentatae* resulted in several corrections (mostly according to Art. 9.9 of *ICN*: McNeill et al. 2012) and second-step lectotypifications. Additional authentic specimens collected by Nuttall, Eschscholtz, and Chamisso (taxa described by Nuttall, Besser, and Lessing, respectively) have been identified in the National Herbarium of Ukraine, KW (Besser and Turczaninov memorial collections).

Finally, we would like to draw attention of researchers working on taxa described by Nuttall, as well as those interested in the history of early botanical exploration of North America, to numerous Nuttall's herbarium specimens deposited in the Turczaninov memorial herbarium at KW. Amazingly, some specimens from KW are even better represented and better preserved than corresponding specimens available from such herbaria as BM, GH, K, PH, etc. In some cases these additional KW specimens can be very useful for establishing the true identity of some taxa. For example, Mosyakin (1995, 2003) was able to restore the neglected name *Corispermum americanum* (Nutt.) Nutt. (Chenopodiaceae) after studying a few fruits (crucially important for identification of *Corispermum* species) available on the isolectotype of this species at KW, while no fruits were available from the lectotype at PH.

ACKNOWLEDGEMENTS

We are grateful to Svitlana I. Antonenko (M.G. Kholodny Institute of Botany of the National Academy of Sciences of Ukraine, KW) for scanning the herbarium specimens from KW, and to Natalia M. Shiyan (Head Curator of KW; M.G. Kholodny Institute of Botany of the National Academy of Sciences of Ukraine) and Alisa V. Shumilova (Curatorial Assistant, KW) for facilitating our herbarium research. Thanks are due to Guy Nesom for his editorial work on the manuscript.

James L. Reveal (1941–2015) provided in 2008 his nomenclatural comments on an earlier version of the manuscript prepared by Leila M. Shultz (published article: Shultz 2009); some of his comments guided our herbarium search, and his expertise was extremely valuable.

LITERATURE CITED

Besser, W.S. [W.S.J.G.] 1829. Absinthium Gaertn. Bulletin de la Société Impériale des Naturalistes de Moscou 1 [Première année], No. 8: 219–224 (introduction), 225–265.

Besser, W.S. [W.S.J.G.] 1832. Tentamen de Abrotanis [typo: "Abotanis"] seu de sectione II^{da} Artemisiarum Linnæi (Extrait des Nouveaux Mémoires de la Société Impériale des Naturalistes de Moscou, Tome III). [St. Petersburg], 92 pp. + 5 tab. Available from: <https://catalog.hathitrust.org/Record/011553698>.

Besser, W.G. [W.S.J.G.] 1834a. Tentamen de Abrotanis seu de sectione II^{da} Artemisiarum Linnæi. Nouveaux Mémoires de la Société Impériale des Naturalistes de Moscou 3: 3–92.

Besser, W.S. [W.S.J.G.] 1834b. De Seriphidiis seu de sectione III^{a} Artemisiarum Linnæi, Dissertatio Botanica. Bulletin de la Société Impériale des Naturalistes de Moscou 7: 5–46.

Besser, W.S. [W.S.J.G.] 1835. Dracunculi seu de sectione IV^{ta} et ultima Artemisiarum Linnæi. Bulletin de la Société Impériale des Naturalistes de Moscou 8: 3–97.

Candolle, A.P., de. "1837" (published January 1838). Prodromus systematis naturalis regni vegetabilis, Vol. 6. Sumptibus Sociorum Treuttel et Würtz, Parisiis [Paris].

Choris, L. 1913. San Francisco one hundred years ago, translated from the French of Louis Choris by Porter Garnett; with illustrations from drawings made by Choris in the year 1816, to which are added certain views of San Francisco at the present day. A.M. Robertson, San Francisco.

Choris, L. 1822. Voyage pittoresque autour du monde, avec des portraits de sauvages d'Amérique, d'Asie, d'Afrique, et des îles du Grand Océan; des paysages, des vues maritimes, et plusieurs objets d'histoire naturelle; accompagné de descriptions par m. le Baron Cuvier, et m. A. de

Chamisso, et d'observations sur les crânes humains, par m. le Docteur Gall. Par m. Louis Choris, peintre. De l'Imprimerie de Firmin Didot, Paris. Plates I–XIV, pp. 1–10, pp. 1–3 (California); plates I–XIX, pp. 1–24 (Hawaii); plates I–XXIII, pp. 1–28 (Alaska). Available from: American Journeys. Eyewitness Accounts of Early American Exploration and Settlement: A Digital Library and Learning Center: <www.americanjourneys.org/aj-087/> (Accessed 10 March 2017); and BHL: <http://dx.doi.org/10.5962/bhl.title.119397>.

Cronquist, A. 1994. *Sphaeromeria*, *Artemisia*. Pp. 142–164, in A. Cronquist, A.H. Holmgren, N.H. Holmgren, J.L. Reveal, and P.K. Holmgren, Intermountain Flora. Vascular plants of the Intermountain West, U.S.A., Vol. 5: Asterales. The New York Botanical Garden, Bronx.

Garcia, S., E.D. McArthur, J. Pellicer, S.C. Sanderson, J. Vallès, and T. Garnatje. 2011a. A molecular phylogenetic approach to western North America endemic *Artemisia* and allies (Asteraceae): untangling the sagebrushes. Amer. J. Bot. 98: 638–653.

Garcia, S., T. Garnatje, E.D. McArthur, J. Pellicer, S.C. Sanderson, and J. Vallès. 2011b. Taxonomic and nomenclatural rearrangements in *Artemisia* subgen. *Tridentatae*, including a redefinition of *Sphaeromeria* (Asteraceae, Anthemideae). W. N. Amer. Naturalist 71: 158–163. Available at <http://scholarsarchive.byu.edu/wnan/vol71/iss2/3>.

Hall, H.M., and F.E. Clements. 1923. The phylogenetic method in taxonomy: The North American species of *Artemisia*, *Chrysothamnus*, and *Atriplex*. Publ. Carnegie Inst. Wash. 326: 1–355.

Holmgren, A.H., L.M. Shultz, and T.K. Lowrey. 1976. *Sphaeromeria*, a genus closer to *Artemisia* than to *Tanacetum* (Asteraceae: Anthemideae). Brittonia 28: 252–262.

IPNI. 2017–onward. The International Plant Names Index. Published on the Internet <http://www.ipni.org>.

Jain, S.K. 1970. A rich, but little known collection of Indian plants in U.S.S.R. J. Bombay Nat. Hist. Soc. 67(3): 620–622.

JSTOR Global Plants. 2017–onward. Available from: <https://plants.jstor.org> (Accessed multiple times during February–March 2017).

Kornkven, A.B., L. Watson, and J. Estes. 1998. Phylogenetic analysis of *Artemisia* section *Tridentatae* (Asteraceae) based on sequences from the internal transcribed spacers (ITS) of nuclear ribosomal DNA. Amer. J. Bot. 85: 1787–1795.

Kornkven, A.B., L. Watson, and J. Estes. 1999. A molecular phylogeny of *Artemisia* sect. *Tridentatae* (Asteraceae) based on chloroplast DNA restriction site variation. Syst. Bot. 24: 69–84.

Korobkov, A.A. 1992. *Artemisia*. Pp. 120–161, in S.S. Charkevicz [С.С. Харкевич; Kharkevich] (ed.), Plantae Vasculares Orientis Extremi Sovietici [Сосудистые растения советского Дальнего Востока], Vol. 6. Nauka, St. Petersburg. [In Russian].

Kotzebue, O., von [with contributions by A. Chamisso, J.F. Eschscholtz, J.C. Hörner, and I.F. Krusenstern; translated from German by H.E. Lloyd]. 1821. A voyage of discovery, into the South Sea and Beering's straits, for the purpose of exploring a North-East Passage, undertaken in the years 1815–1818, at the expense of His Highness the Chancellor of the Empire Count Romanzoff, in the ship *Rurick*, under the command of the Lieutenant in the Russian Imperial Navy, Otto von Kotzebue. Vols. 1–3. Longman, Hurst, Rees, Orme, and Brown, London. Available from: <http://dx.doi.org/10.5962/bhl.title.16948> [Russian version: Коцебу, О. 1821–1823. Путешествие в Южный океан и в Берингов пролив для отыскания северо-восточного морского прохода, предпринятое в 1815, 1816, 1817 и 1818 годах иждивением Его Сиятельства, Господина Государственного канцлера, Графа Николая Петровича Румянцова на корабле *Рюрик* под начальством Флота Лейтенанта Коцебу. В 3-х частях. Типография Ник. Греча, Санкт-Петербург].

Krasnoborov, I.M. 1997. *Artemisia*. Pp. 90–141, in I.M. Krasnoborov (ed.), Flora Sibiriae [Флора Сибири], Vol. 13. Nauka, Novosibirsk. [In Russian].

Krytska, L.I. and S.L. Mosyakin [Крицька, Л.І. & С.Л. Мосякін] (eds.). 2002. Herbarium of the Institute of Botany, NAS of Ukraine, KW [Гербарій Інституту ботаніки НАН України, KW]. Kyiv, 142 pp. [In Ukrainian].

Lessing, Ch.F. 1831. Synanthereae addendae. (De plantis in expeditione Romanzoffiana observatis disserere pergitur. Addendae). Linnaea 6: 501–526.

Ling, Y.-R., C.J. Humphries, and M.G. Gilbert. 2011. *Artemisia*. Pp. 676–737, in Z.Y. Wu, P.H. Raven, and D.Y. Hong (eds.). Flora of China, Vol. 20–21. Science Press, Beijing & Missouri Botanical Garden Press, St. Louis.

Lowrey, T.K. and L.M. Shultz. 2006. *Sphaeromeria*. Pp. 499–502, in Flora of North America Editorial Committee (eds.). Flora of North America North of Mexico, Vol. 19. Oxford Univ. Press, New York & Oxford.

Marchant, N.G. 1990. The contribution of the Russian botanist Turczaninov to Australian plant taxonomy. Pp. 121–130, in P.S. Short (ed.). History of Systematic Botany in Australasia. Proceedings of a symposium held at the University of Melbourne 25–27 May 1988. ASBS, Canberra.

McNeill, J., F.R. Barrie, W.R. Buck, V. Demoulin, W. Greuter, D.L. Hawksworth, P.S. Herendeen, S. Knapp, K. Marhold, J. Prado, W.F. Prud'homme van Reine, J.F. Smith, J.H. Wiersema, and N.J. Turland (eds.). 2012. International Code of Nomenclature for Algae, Fungi and Plants (Melbourne Code): Adopted by the Eighteenth International Botanical Congress, Melbourne, Australia, July 2011. Regnum Vegetabile 154: 1–274.

Mosyakin, S.L. 1995. New taxa of *Corispermum* L. (Chenopodiaceae), with preliminary comments on taxonomy of the genus in North America. Novon 5: 340–353.

Mosyakin, S.L. 2003. *Corispermum*. Pp. 313–320, in Flora of North America Editorial Committee (eds.), Flora of North America North of Mexico, Vol. 4. Oxford Univ. Press, New York & Oxford.

Mosyakin, S.L., G.V. Boiko, and F. Verloove. 2017. Lectotypification of *Artemisia mongolica* (= *A. vulgaris* var. *mongolica*, Asteraceae). Phytotaxa 297: 257–264.

Myakushko, T.Ya. [М'якушко, Т.Я.]. 1976. The scientific heritage of N.S. Turchaninov [Наукова спадщина М.С. Турчанінова]. Ukrayins'k. Bot. Zhurn. [Український ботанічний журнал] 33(6): 647–651. [In Ukrainian].

Nuttall, T. 1818. The Genera of North American plants, and a Catalogue of the Species, to the Year 1817, Vol. 2. Printed for the author by D. Heartt, Philadelphia.

Nuttall, T. 1841. Descriptions of new species and genera of plants in the natural order of the Compositae, collected in a tour across the continent to the Pacific, a residence in Oregon, and a visit to the Sandwich Islands and Upper California, during the years 1834 and 1835. Trans. Amer. Philos. Soc., n. ser. 7: 284–453.

Poljakov, P.P. [Поляков, П.П.; Polyakov]. 1961. *Artemisia*. Pp. 425–631, in B.K. Schischkin [Б.К. Шишкин; Shishkin] and E.G. Bobrov [Е.Г. Бобров] (eds.), Flora URSS [Флора СССР], Vol. 26. Editio Academiae Scientarum URSS, Moscow & Leningrad. [In Russian].

Pursh, F. 1814. Flora Americæ Septentrionalis; or, A systematic arrangement and description of the plants of North America. Containing, besides what have been described by preceding authors, many new and rare species, collected during twelve years travels and residence in that country, Vol. 2. Printed for White, Cochrane, and Co., London [Printed by Richard and Arthur Taylor, London].

Reveal, J.L., A.E. Schuyler, and G.E. Moulton. 1999. The Lewis and Clark collections of vascular plants: Names, types and comments. Proc. Acad. Natural Sci. Philadelphia 149: 1–64.

Rydberg, P.A. 1900. Catalogue of the flora of Montana and the Yellowstone National Park. Mem. New York Bot. Gard. 1: i–xi + 1–492.

Rydberg, P.A. 1916. Anthemideae. North American Flora 34(3): 217–288.

Sanz, M., V. Vilatersana, O. Hidalgo, N. Garcia-Jacas, A. Susanna, G.M. Schneeweiss, and J. Vallès. 2008. Molecular phylogeny and evolution of floral characters of *Artemisia* and allies

(Anthemideae, Asteraceae): Evidence from nrDNA ETS and ITS sequences. Taxon 57: 66–78.

Shiyan, N.M. [Шиян, Н.М.] (ed.). 2011. Herbaria of Ukraine. Index Herbariorum Ucrainicum [Гербарії України. Index Herbariorum Ucrainicum]. Alterpress, Kyiv, 444 pp. [In Ukrainian, with abridged reference part (pp. 393–442) in English].

Shultz, L.M. 2006a. *Picrothamnus*. Pp. 498–499, in Flora of North America Editorial Committee (eds.), Flora of North America North of Mexico, Vol. 19. Oxford Univ. Press, New York & Oxford.

Shultz, L.M. 2006b. *Artemisia*. Pp. 503–534, in Flora of North America Editorial Committee (eds.). Flora of North America North of Mexico, Vol. 19. Oxford Univ. Press, New York & Oxford.

Shultz, L.M. 2009. Monograph of *Artemisia* subgenus *Tridentatae* (Asteraceae–Anthemideae). Syst. Bot. Monogr. 89: 1–131.

Stafleu, F.A. and R.S. Cowan. 1976. Taxonomic literature. A selective guide to botanical publications and collections with dates, commentaries and types, ed. 2, Vol. 1: A–G. Bohn, Scheltema & Holkema, Utrecht.

Stafleu, F.A. and R.S. Cowan. 1981. Taxonomic Literature: A Selective Guide to Botanical Publications and Collections with Dates, Commentaries and Types, ed. 2, Vol. 3: Lh–O. Bohn, Scheltema & Holkema, Utrecht & dr. W. Junk b.v., Publishers, The Hague.

Stafleu, F.A. and R.S. Cowan. 1986. Taxonomic Literature: A Selective Guide to Botanical Publications and Collections with Dates, Commentaries and Types, ed. 2, Vol. 6: Sti–Vuy. Bohn, Scheltema & Holkema, Utrecht/Antwerpen & dr. W. Junk b.v., Publishers, The Hague/Boston.

Thiers, B. 2017–onward. *Index Herbariorum*. A Global Directory of Public Herbaria and Associated Staff. New York Botanical Garden's Virtual Herbarium. Available from: <http://sweetgum.nybg.org/science/ih>.

Torrell, M., N. Garcia-Jacas, A. Susanna, and J. Vallès. 1999. Phylogeny in *Artemisia* (Asteraceae, Anthemideae) inferred from nuclear ribosomal DNA (ITS) sequences. Taxon 48: 721–736.

Vallès, J., M. Torrell, T. Garnatje, N. Garcia-Jacas, R. Vilatersana, and A. Susanna. 2003. The genus *Artemisia* and its allies: Phylogeny of the subtribe Artemisiinae (Asteraceae, Anthemideae) based on nucleotide sequences of nuclear ribosomal DNA internal transcribed spacers (ITS). Pl. Biol. 5: 274–284.

Watson, L., P. Bates, T. Evans, M. Unwin, and J. Estes. 2002. Molecular phylogeny of subtribe Artemisiinae (Asteraceae) including *Artemisia* and its allied and segregate genera. BMC Evol. Biol. 2: 17 pp. <http://www.biomedcentral.com/1471-2148/2/17>.

Figure 1. Isolectotypes of *Artemisia trifida* Nutt. (KW001002845, upper right; KW001002846, upper left) and possible isolectotype of *A. trifida* var. *rigida* Nutt. (KW001002847, bottom).

Figure 2. Isolectotype (KW001002849, bottom) and possible isolectotype (KW001002848, top) of *Artemisia arbuscula* Nutt.

Figure 3. Isolectotype of *Artemisia tridentata* Nutt. (KW001002841).

Figure 4. Isolectotype of *Artemisia californica* Lessing (KW001000941).

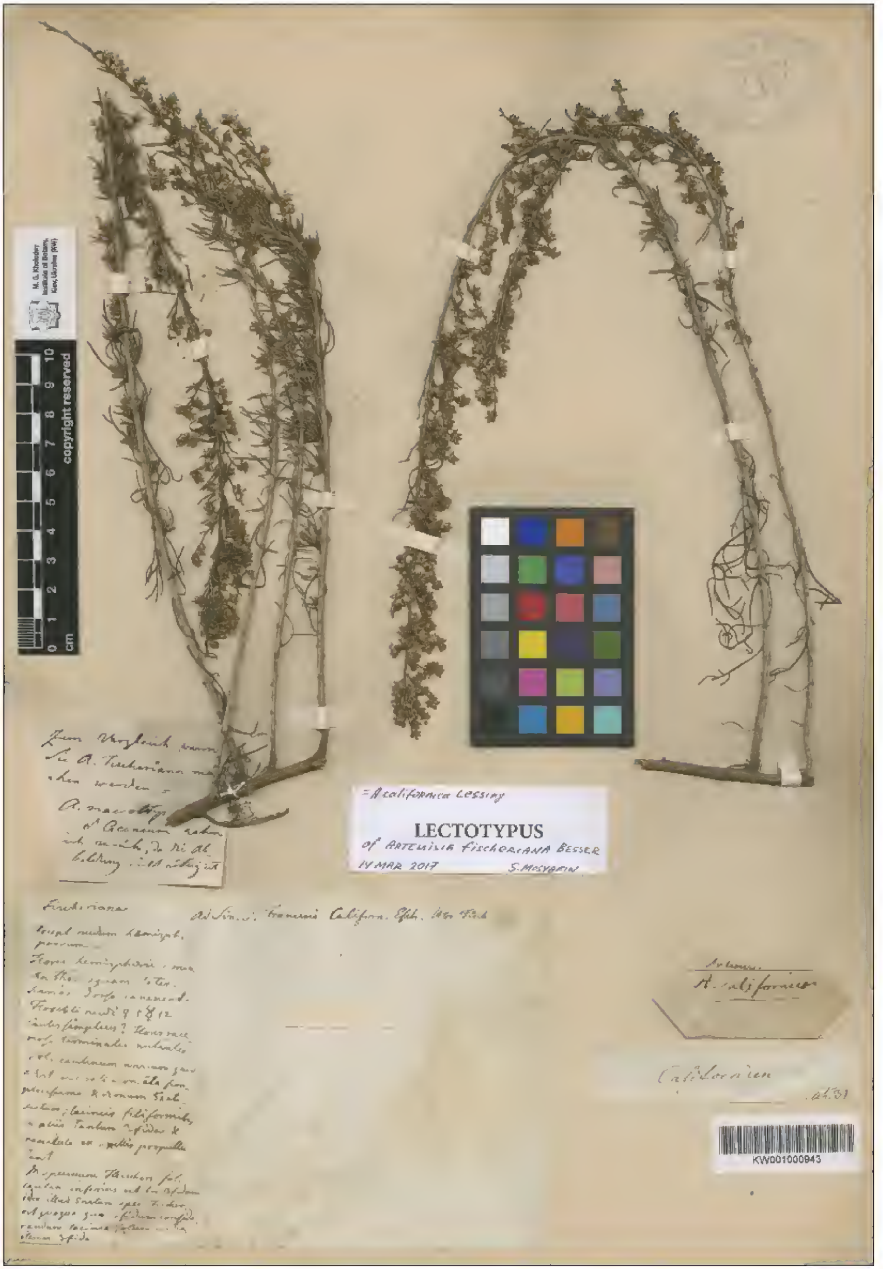

Figure 5. Lectotype of *Artemisia fischeriana* Besser (KW001000943).

Figure 6. Isolectotype of *Artemisia fischeriana* Besser (KW001000942).

Figure 7. Isolectotype of *Artemisia fischeriana* Besser (KW001000938, left) and a historical specimen collected by L. Choris (KW001000939, right).

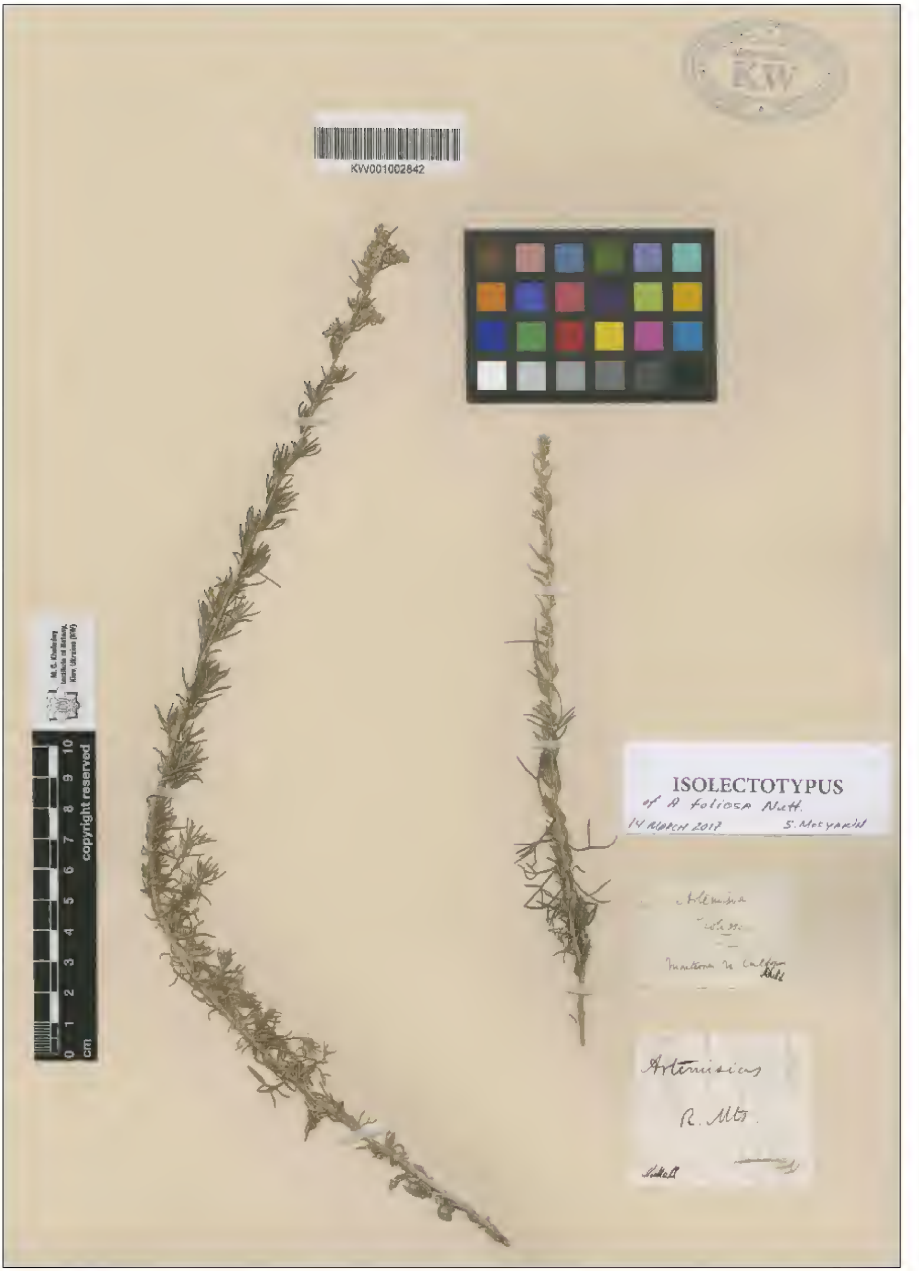

Figure 8. Isolectotype of *Artemisia foliosa* Nutt. (KW001002842).

Figure 9. Isolectotypes of *Artemisia pedatifida* Nutt. (KW001002850 and KW001002851).